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DEFINING THE LINGUISTIC MEANS OF SCIENTIFIC AND TECHNICAL COMMUNICATION IN THE TRAINING OF ENGINEERS

Abstract. Changes in the higher education system predetermine the need for scientific understanding of the process of scientific and professional activities formation, which play a key role in the development of knowledge, innovation and solving complex problems in the field of science and technology. The article examines the problem of scientific training of engineers, which lies in the need to substantiate and develop technology for the formation of scientific and professional competence of technical university students in the process of teaching the scientific language, that is, teaching scientific communication in engineering. The authors presented research of scientific and linguistic system of technical personnel training through a theoretical review of foreign experience in order to determine key linguistic means of scientific and technical communication and a questionnaire survey to assess the applicability of linguistic means of scientific discourse in the training of engineering and technical personnel.

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Keywords: linguistic means; scientific communication; training of engineers; theoretical review; questionnaire survey; data analysis.

Introduction

The role of language in scientific training cannot be overestimated. In an era of rapid information exchange and knowledge globalization, scientific language acquisition is no longer limited to mere linguistic knowledge. It is a dynamic tool for successful transmission of scientific ideas, an instrument of innovation and a catalyst for the development of cross-cultural communication in finding solutions to multifaceted global problems. Scientists have long recognized the need for precise terminology and clear expression to communicate complex ideas. As science has developed, the role of language has evolved, extending far beyond the traditional boundaries of journal articles and scientific conferences to embrace the vast digital sphere in which data is shared and international collaboration occurs.

The purpose of this research on the intensification of scientific training of technical specialists is to identify the role of language in the scientific training of future engineers and to determine linguistic means in the process of scientific and technical communication.

The conducted content analysis of the concepts “ linguistic means” and “scientific and technical communication” made it possible to determine their significance and relevance, and to consider foreign practice of using linguistic means in the process of scientific communication. According to Hyland (2011), language becomes a form of presentation of interpretations in the scientific genre, which requires adherence to certain patterns regarding the linguistic means. Language influences thinking because it offers cognitive means for developing mental shortcuts. Scientific texts are designed to convince readers of the knowledge underlying a research article or dissertation. To achieve these different goals, scientists tend to use the same repertoire of linguistic means over and over again (Hyland, 2011).

Researchers emphasize that linguistic means of formalizing scientific (professional) speech are designed to ensure accurate perception, recording and transmission of information exchanged between specialist communicators, since the linguistic component occupies an important place in the system of scientific communication. Written recording and transmission of scientific (special) information requires some work on the linguistic forms of its expression. The pattern of use of linguistic means in scientific texts is determined by a number of factors; the main ones being objectivity, accuracy, information content, and logic (Mikhaylenko, 2014, p. 78).

Currently, scientific communication is:

- a set of processes for transmitting and receiving scientific information in society, forming the main mechanism for the existence and development of science;
- means of popularizing the results of scientific activity and activating the processes of new knowledge exchange (Gladkova, 2009, p. 162);
- exchange of information between people involved in science professionally (Mikhaylenko, 2014, p. 80).

The means of scientific communication include all kinds of forms of exchange and dissemination of scientific information. Traditional (or classical) means of scientific communication are usually divided into formal, semi-formal and informal. Formal and semi-formal communications are documentary sources of information. These include, first of all, formal documents officially published in scientific publications: journal articles, collections of scientific papers, conference proceedings, monographs. Semi-formal documents are manuscripts, preprints, scientific reports, text messages, etc. (Gladkova, 2009, p. 162).

Successful scientific communication today largely depends on the level of information culture of scientists, researchers, teachers and students and on their ability to use the latest information and communication technologies (Talishinski, 2021, p. 113). Digital technologies significantly accelerate the development of society, enhance the role and importance of information and knowledge, transform knowledge into a direct creative force; expand and enrich information exchange channels; make the transition from book communication to multimedia and form modern models of scientific interaction.

According to linguists, a number of linguistic means contribute to the fulfillment of this requirement in scientific texts. Written documents of scientific nature are complex linguistic forms, the main purpose of which is to convey information to the reader (Mehler & Romary, 2012).

Methodology

To conduct the research, a combination of the following methods was used: 1) comparative analysis of foreign and domestic sources on linguistic means of scientific communication of technical specialists; 2) content analysis of the concept of “linguistic means” and “scientific communication”; 3) quantitative and qualitative methods of collecting information; 4) questionnaire survey for teachers and linguists of technical university to identify linguistic means of scientific and technical communication; 5) systematic analysis of the obtained data.

Analysis of the research problem

Scientific and technical communication is distinguished by its inherent characteristics, which can serve as an obstacle to understanding scientific and technical texts.

Technical documentation conveys information that readers must interpret unambiguously. Among the most important points to pay attention to in the field of scientific and technical communication is the clarity of documents of scientific nature (Mehler & Romary, 2012). The specialized terminology and jargon inherent in scientific and technical

communication can create barriers to effective communication. Also, cultural and linguistic diversity can complicate the process of translation and interdisciplinary discourse. Communicating complex concepts requires a delicate balance between accuracy and accessibility.

In technical and natural sciences, an unambiguous definition of terms is possible, which is associated with the designation of specifically observable, objectively existing processes and phenomena of the surrounding world. In fields such as engineering, medicine, and computer science, precise language is essential to convey important information. The definitions of such terms can be changed and clarified regarding the linguistic form of expression, however their content must remain unchanged, since this is what ensures the unambiguity of the term, its accuracy and information content (Mikhaylenko, 2014, p. 81).

Herbert (1999) divides terms into two categories: highly specialized terms, which usually have a very specialized meaning; "semi-scientific or semi-technical words having a range of meanings and often used idiomatically (for example, work, plant, load, feed, force)." Godman and Payne distinguish between two types of terms: technical terms and non-technical terms. Technical terms are those terms whose concepts are the same across all sciences, regardless of the language used. In each case, the properties of the characteristic can be enumerated to uniquely define the object. Non-technical terms are divided into general language terms (e.g. coordinators, subordinators, determiners, quantifiers) (Pearson, 1998).

Scientific and technical terminology, which, as Gredina (2010) writes, is the most mobile layer of vocabulary, subject to constant and active enrichment and change due to the scientific unification of the terminology of a particular field of knowledge.This is due to the fact that terminology develops taking into account new technologies and concepts, serves as a bridge for the transfer and expansion of knowledge from one generation of experts to another; accordingly, when new terms are introduced or existing ones are developed, the latest achievements and ideas in a certain scientific direction are reflected. In engineering, problem solving often involves identifying and analyzing specific components or processes in technical fields, creating new terms to describe new inventions and discoveries. Moreover, in interdisciplinary research, terminology acts as a common language that transcends the boundaries of individual fields. For example, this is especially valuable in fields such as bioinformatics, where biologists and computer scientists need to understand each other's work.

In scientific articles, accurate terminology is critical for peer review because terminological clarity ensures that reviewers can accurately evaluate methods and results. Reviewers rely on terminology to evaluate the validity and accuracy of research papers. Technical documents such as manuals, textbooks, instructions, guidelines rely heavily on terminology. For example, in the automotive industry, technical guidelines use standardized terminology to describe vehicle components, maintenance procedures, and repair instructions.

It should be noted that technical terminology may vary depending on language and culture. Accurate translation of technical terms can be challenging because not all concepts have direct meanings in other languages. This can create problems in international collaboration and dissemination of research.

Louis Anke (2013), in his study on the classification of different styles of terms definitions, gives high importance to definitions, which play an important role in the information age. The need to structure the information available on the Internet is obvious, since the volume of information is growing every day. Understanding the meaning of words can be achieved through the existence of glossaries or special dictionaries.

Therefore, as the first linguistic means of scientific and technical communication, we highlight terminology, which plays a fundamental role in technical fields by providing a standardized and precise language for defining concepts, processes and phenomena. This precise use of specific terms and definitions is critical to effective communication, knowledge

dissemination, and problem solving in technical fields.. Standardized terminology ensures that all technical experts understand and use the same language, which is especially important in interdisciplinary research and collaboration, where experts from different scientific fields need to communicate effectively, facilitating the exchange of information. Using specific terms and definitions makes communication easier, more effective, and allows to accurately diagnose the problem, develop the solution, and document the results.

Importantly, abbreviations and acronyms are concise and effective tools for representing complex concepts and various terminologies. In technical fields where accuracy is of utmost importance, abbreviations and acronyms help maintain clarity and consistency, establishing a standardized language for describing specific concepts or objects, reducing the risk of misinterpretation.

Technical documents and reports often contain repeated terms and phrases. Abbreviations and acronyms reduce redundancy and improve the readability of documents by highlighting key information. Students who are not familiar with specific acronyms and abbreviations used in technical fields may find the documents difficult to understand, which can limit the accessibility of research and information. When translating technical documentation into other languages, abbreviations and acronyms can be difficult to translate, as some of them may not have direct equivalents in other languages. Moreover, problems such as ambiguity and overuse must be effectively solved to maintain the readability and accessibility of scientific text.

Consequently, we have highlighted abbreviations and acronyms as a separate significant linguistic means of scientific and technical communication.

The next key linguistic means of scientific and technical communication are technical drawings and diagram**s** – tools used for academic and research purposes to visually represent complex concepts, projects, and research results. These graphical elements serve as an important means of conveying information, enhancing understanding, and promoting effective communication within and between different fields of science.

One of the fundamental roles of technical drawings and diagrams for academic and research purposes is to enhance the clarity of information presentation. These visuals help simplify complex concepts and structures, making them more accessible to a wider audience due to the ability to convey ideas, which greatly improves understanding. Technical drawings and diagrams serve as tools to facilitate understanding of a scientific field.

Taffesse and Cassa (2005) note that a drawing, a graphic representation of an object, is the result of the creative thought of an engineer or technician. When one person draws a rough provision card towards another, this is graphic communication. Drawings, photographs, slides, transparencies, and sketches are all forms of graphic communication. Any medium that uses a graphic image to convey a message, instructions, or idea is involved in graphic communication.

One of the most widely used forms of graphic communication is drawing. Technically, it can be defined as “a graphic representation of an idea, concept, or entity that actually or potentially exists in life.”

According to Taffassa and Kassa (2005), there are two main types of drawings: artistic drawings and technical drawings. A technical drawing is a means of clearly and concisely conveying all the information needed to bring an idea or concept into reality. Therefore, a technical drawing often contains more than just a graphic representation of the subject. It also contains dimensions, notes and specifications.

In research activities, technical drawings and diagrams play a crucial role in making abstract or theoretical concepts tangible. In mathematics, graphs and geometric diagrams are used to explain abstract mathematical concepts.

According to NASA’s Manual of Engineering Drawing Standards, technical drawings and diagrams must adhere to standardized conventions and rules. For example, technical

drawings comply with American Society of Mechanical Engineers (ASME) standards or International Organization for Standardization (ISO) standards. This compliance ensures consistency, accuracy and uniformity in the presentation of information (Scientific and Operational Requirements for TOMS Data, 1986).

Technical drawings and diagrams serve as vital links between diverse disciplines. Researchers from different backgrounds can use visuals as common reference points to understand and collaborate on complex projects. For example, in bioinformatics, diagrams depicting genetic sequences and protein structures facilitate collaboration between biologists and computer scientists. Such interdisciplinary collaboration is essential for the development of knowledge in new areas that require experience from different fields.

Technical drawings and diagrams are effective communication tools in academic and research contexts. During presentations, scientific articles, and research reports, these visuals complement textual content by breaking down complex details into easy-to-understand formats.

As part of international research collaborations, technical drawings and diagrams overcome language barriers. These visuals provide a universal communication tool that allows researchers with different linguistic backgrounds to collaborate effectively. This is especially important in today's globalized academic environment. This promotes inclusivity and allows researchers from different cultures to contribute to global knowledge.

Efficient presentation of numerical results, supplemented by well-designed graphs and tables is fundamental to scientific research. Numerical data provides the basis for scientific results. A clear and well-organized numerical presentation increases the interpretability of research results, allowing other researchers to understand, learn from, and build on the work. When numerical results are properly visualized, they help identify trends, patterns, and relationships that may not be immediately obvious from raw numbers alone. In this case, the numerical representation helps researchers identify correlations and draw valid conclusions.

Data collection and analysis provide the basis for decision making, verification, safety assessment, and performance assessment in scientific and technical research. According to generally accepted concepts of scientific discourse, the presentation, discussion and analysis of experimental data requires statistical calculations, in which mathematical or symbolic logic is used in scientific communication.Mathematical logic is based primarily on methods for constructing logical calculi based on a strict symbolic language, axiomatization and formalization.

Therefore, the following linguistic means has the significance of engineering data, which can be complex and multifaceted. Effective communication of engineering results is essential for collaboration and knowledge transfer. Numerical data provides the basis for documentation and reporting, allowing engineers to communicate their findings clearly and concisely, making them easier to analyze and interpret.

Citation of sources is an undeniable aspect of scientific research and contributes to greater openness of scientific publications, which has become our next linguistic means of scientific and technical communication.

Thomas Annesley (2011) interprets that proper citation allows researchers to show how their work builds on existing knowledge, providing context and credibility to their own findings. It also encourages further research and development of ideas. In a technical environment, the fundamental principles are verification of results and reproducibility of experiments. Proper citation provides necessary references for other researchers to verify the accuracy and validity of the work, replicate experiments, and develop existing knowledge.

According to Teresa Brochet (2009), standard citation styles such as APA and MLA were originally developed for other disciplines, they have also been adapted for use in technical texts.

Citation of sources serves as a mechanism for ensuring the quality of technical publications. Reviewers evaluate the accuracy and appropriateness of citations as part of the review process, ensuring the integrity of the research. As technical research becomes increasingly global, proper citation practice facilitate international collaboration. Researchers from different regions can more effectively understand and contribute to each other's work. For engineering researchers, proper citation of sources is a sign of professionalism. Citation of sources using standard technical citation styles is fundamental to scientific and professional communication and supports intellectual integrity. Researchers and teachers have a shared responsibility for prioritizing and promoting proper citation practice to ensure that the technical community continues to engage in ethical scientific and professional discourse.

Formal style of text in engineering science is one of the key components with the help of which researchers and scientists communicate their findings, methodologies and ideas. In the field of engineering, which covers disciplines such as physics, chemistry, computer science, and biology, the use of formal sentence structures and language is of paramount importance. Formal writing style provides a structure that enhances clarity and ensures that the intended message is accurately conveyed to a diverse audience of scholars and researchers.

Robert Goldbort (2006) notes that technical research often involves experiments and studies that need to be replicated for verification. Formal writing style provides the level of detail necessary for others to accurately reproduce the work, promoting the principles of the scientific method. Ambiguity is reduced by formal language. Each sentence has a clear interpretation, minimizing the risk of misunderstanding.

In engineering research, formal writing style is not just a stylistic choice; it is a means of ensuring clear and precise communication. This allows complex ideas to be conveyed accurately and objectively. Through structured organization of sentences and paragraphs, precise terminology, avoidance of ambiguity, and elimination of personal biases, formal writing style serves as a means of sharing knowledge, promoting the development of engineering.

An equally important component in the presentation and organization of research results is text structuring, which serves as a critical tool for increasing clarity, facilitating navigation and effectively communicating complex information. Structuring the text into sections and subsections provides a clear and organized structure. Often, complex technical documents can be lengthy. Structured text with headings and numbering helps readers navigate content efficiently, allowing them to quickly find the information they need. Structuring the text ensures a logical flow of ideas. This helps authors present their work in a systematic manner, making it easier for readers to follow the narrative.

Structured text emphasizes key concepts and provides pointers to help readers understand the content. This helps highlight important information and maintain interaction. For example: a bold “Key Findings” heading signals the start of significant results. Subheadings such as “Discussion” and “Conclusion” guide readers through the analysis and summary of the research.

Technical content reports rely heavily on structured text to systematically document experiments, observations, and project results. Ranked engineering journals follow a structured format with sections for abstracts, introductions, methods, conclusions, discussions, and references. This promotes consistency and readability. Logical organization that allows for efficient scanning and highlights key points ensures that technical documents are accessible and understandable to a diverse audience of researchers, students, and experts.

Thus, logical text structuring is a key linguistic means of scientific and technical communication, since the construction of logical sequences of ideas and arguments of a scientific text is necessary for a convincing presentation of scientific conclusions. As Levitt et al. (2018) notice logical structure is the basis of a persuasive scientific argument. It ensures

that scientific findings are presented clearly, coherently and effectively. In addition, it is worth remembering that a logical structure not only serves to convey conclusions, but also deepens one's own understanding of research, making it a fundamental component of scientific research and communication.

In scientific research and communication, constructing logical arguments and coherently organizing ideas is paramount to effectively presenting results. A logically structured research paper enhances the credibility of scientific results by demonstrating that conclusions are based on a systematic and rigorous approach, thereby increasing their credibility.

The use of specific expressions and vocabulary characteristic of the scientific style is a key requirement. This specialized language serves several important functions, including conveying precision, objectivity, and a systematic approach to research and analysis. Academic expressions integrate the research process and its results, demonstrating a commitment to systematic research and analysis, for example: “According to our research, the hypothesis was confirmed.”

For example, a phrase such as “According to research”: used to attribute conclusions or statements to previously conducted research. Example: “According to nanotechnology research, the properties of nanoscale materials are significantly different from bulk materials.”

In summary, it is necessary to emphasize the importance of using academic expressions and scientific vocabulary as an integral part of effective communication, accuracy, and maintaining a scientific tone. These expressions serve to emphasize the rigor of the research, objectivity, and systematic analysis. They are widely used in research papers, technical reports, scientific journals and educational materials, providing clear and authoritative presentation of information. The strategic use of these expressions not only enhances the credibility of technical discourse, but also promotes a culture of rigorous research and documentation within the scientific community.

In the field of engineering, maintaining high precision of grammar and punctuation is an important element to ensure clear and precise communication.

In technical sciences, where complex ideas and data are presented, precision in grammar and punctuation is critical to ensure that the message is conveyed clearly and comprehensively. Ambiguity or errors may interfere with understanding. Engineering research papers require precision in grammar and punctuation to accurately present methodologies, results, and conclusions. Ambiguities in language may lead to misinterpretation.

Maintaining high precision in the use of grammatical rules and punctuation to prevent ambiguity and misunderstanding in technical sciences is non-negotiable. Scholars and researchers must adhere to the highest standards of precision in grammar and punctuation to ensure their work is accessible, credible, and effective. Researchers Bajaj et al. (2023) write about the purity of scientific text in terms of precision grammar.

Thus, the analysis of scientific literature made it possible to identify nine key linguistic means of scientific and technical communication: terminology, abbreviations and acronyms, technical drawings and diagrams, engineering data (numbers, formulas, etc.), citation, formal style of communication, logical text structuring, academic expressions and vocabulary, precision grammar and punctuation.

Results and discussion

Linguistic means play an important role in scientific and technical communication. They are the main tool for transmitting scientific and technical knowledge, as well as a way of expressing and structuring thoughts and ideas in oral and written scientific communication. Correct use of linguistic means establishes a clear and understandable connection between the author and the reader, facilitating the process of transmitting scientific and technical information. In order to evaluate linguistic means of scientific and technical communication

used in practice (terminology, style, grammar, etc.) among teachers and linguists of a technical university, as well as to study the motives and reasons that influence the choice of certain linguistic means, the survey "Choice of linguistic means in scientific and technical communication" was conducted.

The survey assumes a rigidly fixed order, content and form of responses with the registration of respondents alone with themselves. This survey is classified according to the content and design of the questions asked. The survey questions have the following classification: -by content: a) the main questions formulated to obtain the necessary information about the subject of the study; b) control tests, the functional purpose of which is to verify the veracity of answers to basic questions, to clarify the information received. -by design: a) closed - the survey contains several possible answers. To answer a closed question, the respondent must mark the selected answer option (circle the corresponding number or simply emphasize the answer option); b) semi-closed - if answers are not provided as much as possible; d) Yes-No questions.

The assessment survey consists of five parts: 1. Social-demographical questions, which allow the classification of respondents in accordance with the specified characteristics; 2. General opinion on the quality of education; 3. Evaluation of written communication; 4. Evaluation of oral communication; 5. Additional comments and suggestions.

Part 1. 267 people took part in the survey, of which: 41.8% are senior teachers; 31.3% are teachers; 22.4% are associate professors; 3% are professors and 1.5% are heads of departments. Teachers from different educational organizations of Kazakhstan and abroad took part in the survey: Pan-European University (Bratislava, Slovakia), K.I. Satpayev Kazakh National Research Technical University, Abylkas Saginov Karaganda Technical University, Polytechnic College of the Kazakhmys Corporation, International Educational Corporation, Abai Kazakh National Pedagogical University, Buketov Karaganda University. Of the 267 respondents, 27.8% of respondents are Russian Language teachers, 47.8% are Foreign Language teachers, 24.4% of respondents are Kazakh Language teachers.

As a result of the survey on teaching experience, the following results were obtained: 58.2% of respondents have teaching experience of 20 years or more; 26.8% have 10 to 20 years of teaching experience; 9% have 5 to 10 years of teaching experience; 6% have up to 5 years of teaching experience.

Part 2. For the first part, "General opinion about the quality of training," respondents were asked to answer 10 questions. The diagrams below highlight the responses.

Figure 1

"What role do linguistic means play in scientific and technical communication?"

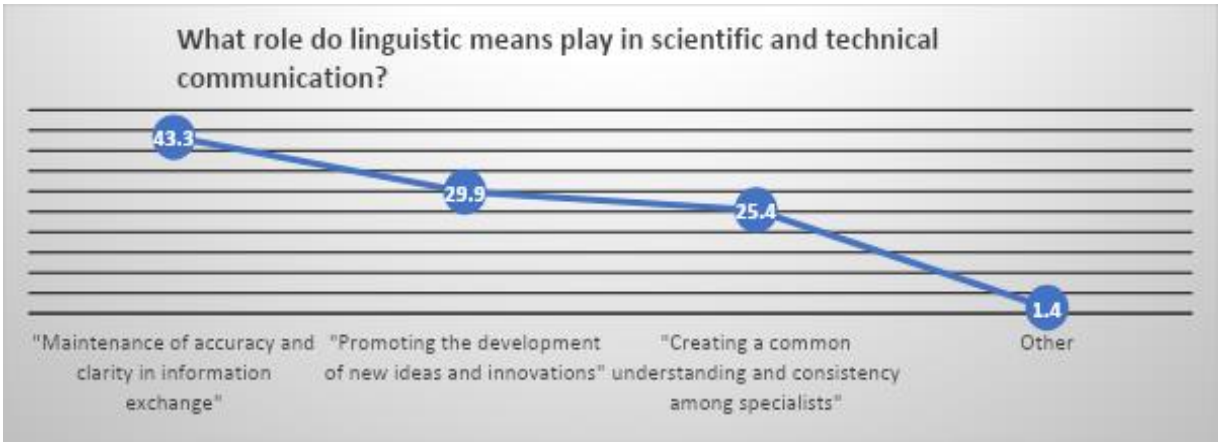
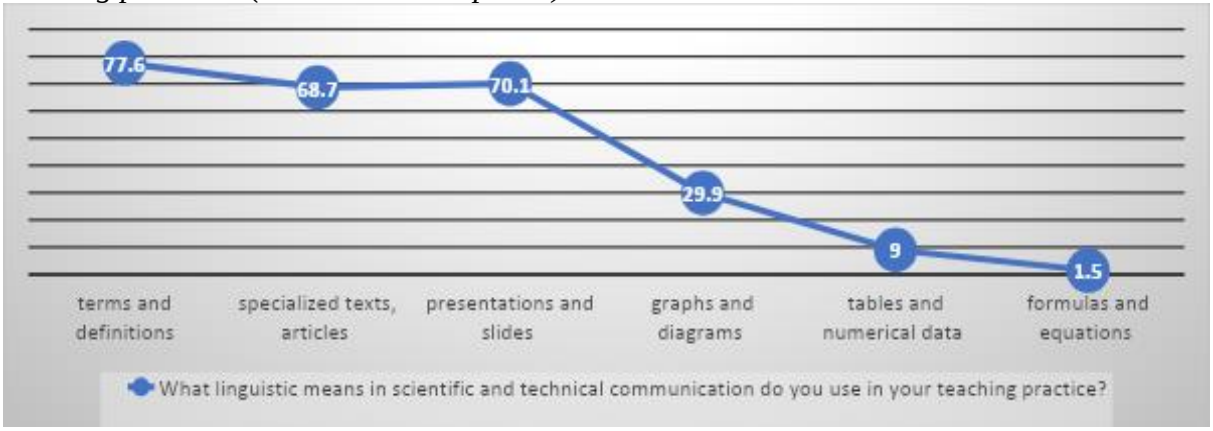


Figure 2

"What linguistic means in scientific and technical communication do you use in your teaching practice? (choose several options)"



Regarding the question "What methods and approaches do you use to help students understand and use linguistic means in scientific and technical communication? (choose several options)" respondents most often indicated the following answers: practical exercises and assignments - 80.6%, group classes and discussions - 70.1%, explanations and demonstrations - 62.7%, use of online resources and training programs - 46.3%. Much less frequently, respondents chose the answer "use of real examples and projects" – 25.4%, a possible reason for its low popularity may be the lack of available resources or materials for this approach. Additionally, some teachers may feel that using real examples and projects requires more time and effort to prepare and organize classes.

For the question "Do you consider it necessary to develop specialized educational materials or courses on linguistic means in scientific and technical communication?" the vast majority responded positively (98.5%).

Regarding the question "What modern technologies and online resources do you use or recommend to support linguistic means teaching in scientific and technical communication? (choose several options)" the following answers were received: electronic textbooks and resources – 89.6%, online courses and platforms – 52.2%, specialized programs and applications – 41.8%, virtual laboratories are used by only 3% of respondents. The reason for the low percentage of use of virtual laboratories may be the need for physical presence and access to specialized equipment to conduct experiments. Perhaps respondents prefer more traditional teaching methods and think that virtual labs cannot fully replace real-life experience. Additionally, virtual laboratories are not yet as widespread or accessible for use in scientific and technical communication.

For the question "Are you ready to participate in professional training or seminars to develop skills in linguistic means teaching in scientific and technical communication?" the majority of respondents answered that they are ready (89.6%) and only 10.4% of respondents answered negatively.

Figure 3

"Choose one or more challenges that you see in linguistic means teaching in scientific and technical communication"

For the question "On a scale from 1 to 5, rate the quality of linguistic means teaching in scientific and technical written communication (1 - very bad, 5 - excellent)" The reason for low grades may be ineffective teaching of linguistic means in scientific and technical written communication, lack of qualifications of teachers, lack of suitable educational materials, unsatisfactory level of student preparation.

Figure 4

On a scale from 1 to 5, rate the quality of linguistic means teaching in scientific and technical written communication (1 - very bad, 5 - excellent)"

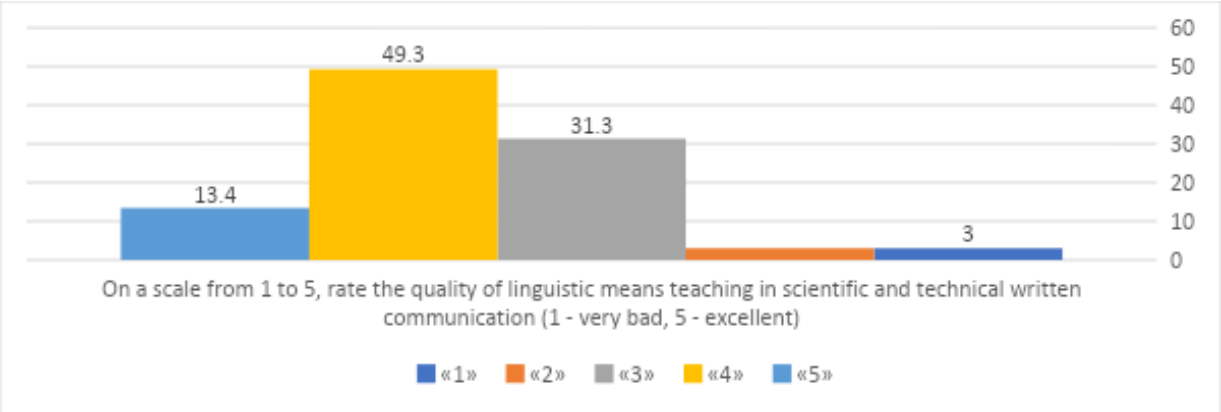
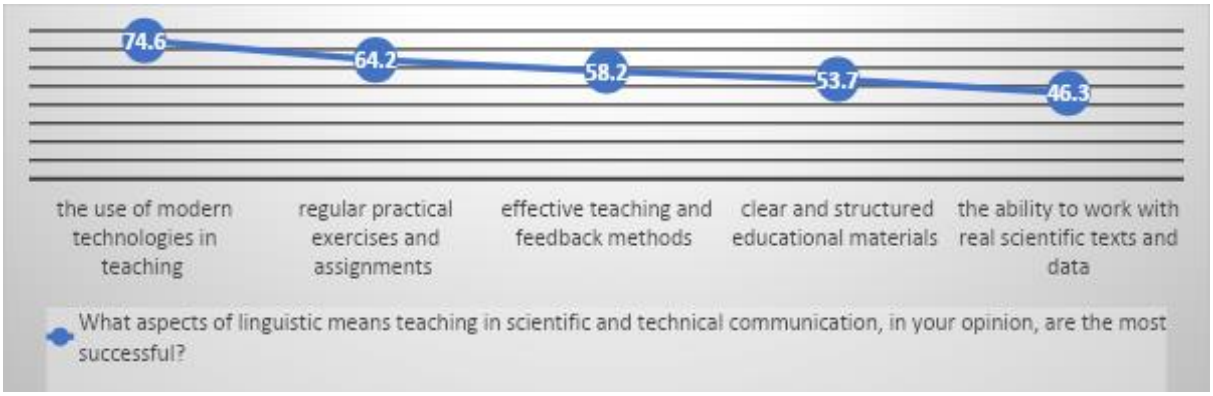


Figure 5

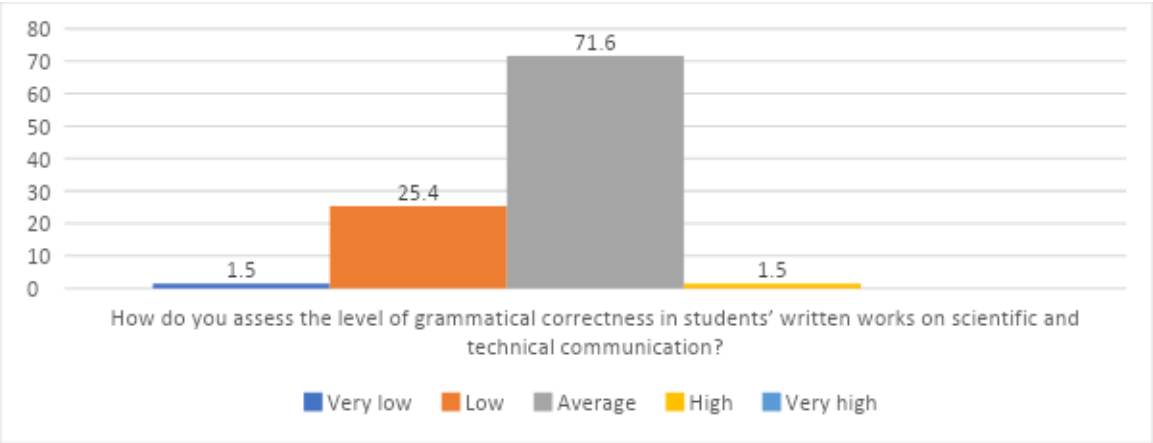
"*What aspects of linguistic means teaching in scientific and technical communication, in your opinion, are the most successful? (choose several options)"*



*Part 3***.** In the next section of questions, respondents were asked to assess written communication. Regarding the question "How do you assess the level of grammatical correctness in students' written works on scientific and technical communication?" the overwhelming majority of respondents (71.6%) think that the level of grammatical correctness in students' written works on scientific and technical communication is average. Lack of practice in written communication may be the reason for low level of grammatical correctness.

Figure 6

"How do you assess the level of grammatical correctness in students' written works on scientific and technical communication?"



For the question "Assess the level of clarity and consistency in the expression of ideas in students' written works", (diagram 5)the reasons for the low level of clarity and consistency in the expression of ideas in students' written works may be insufficient knowledge of the subject and the inability to structure and express their thoughts, as well as a lack of written expression skills. Most students do not have enough practice in writing essays, scientific articles and other types of written work.

Figure 7

"Assess the level of clarity and consistency in the expression of ideas in students' written work"

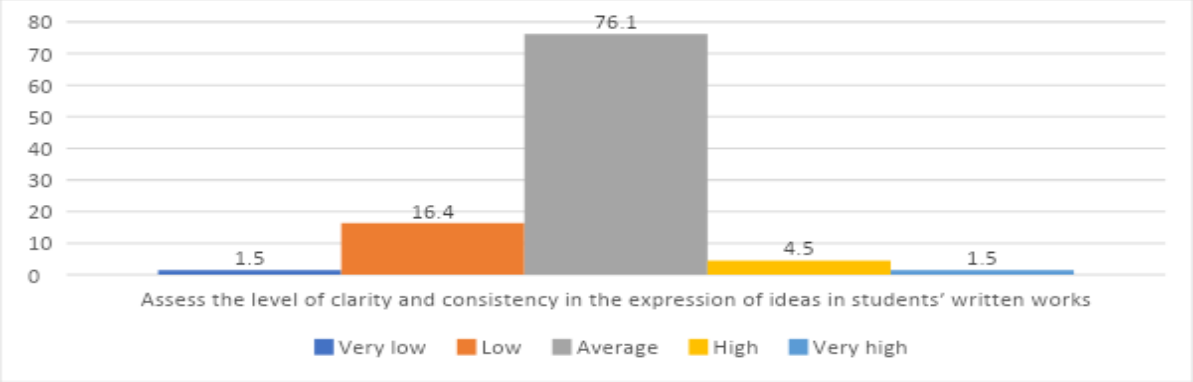
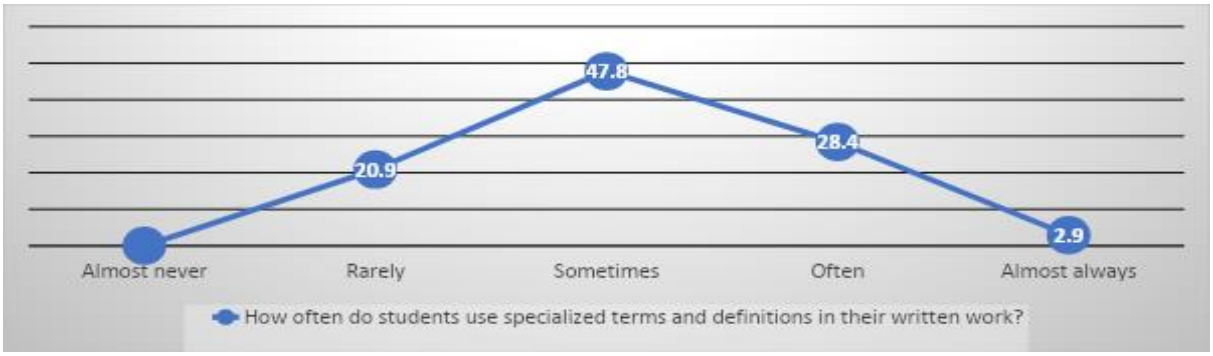


Figure 8

"How often do students use specialized terms and definitions in their written work?"



From the received answers, we can conclude that there is a low percentage of using terms in students' written work, which is most likely explained by the fact that students do not know the conceptual and scientific apparatus on the topic of written work and do not always understand the importance and significance of terminology in educational and scientific communication.

Figure 9

"What aspects of written communication, in your opinion, require more attention in teaching?" (choose several options)

Part 3. In the third section of questions, respondents were asked to assess oral communication. Regarding the question “How do you assess students’ level of oral clarity and articulation in oral communication on scientific and technical subject?” 86.6% of respondents assess the level of students' oral clarity and articulation in oral communication on scientific and technical subject as average; 7.5% of respondents noted a high level of students’ oral clarity and articulation in oral communication on scientific and technical subject, and only 6% of respondents chose the answers “low” and “very low” (4.5% and 1.5%, respectively). Insufficient level of qualitative oral expression among students is characterized by insufficient practice of oral speech in the language, passive vocabulary, including terminological vocabulary on specialisation, as well as insufficient level of motivation in reading scientific and specialised literature in the process of learning.

For the question “Assess the ability of students to express ideas in oral communication" the vast majority of respondents (79.1%) assessed the ability of students to express ideas in oral communication as average, 10.4% of respondents noted low ability of students to express ideas in oral communication, 9% of respondents noted high ability of students express ideas in oral communication and only 1.5% noted a very low ability of students to express ideas in oral communication. Expressing ideas in language, including scientific language, requires high level of proficiency in scientific style, which is characterized by the accuracy of transmitted information and accessibility of presentation, which is a difficult process for students. The average level in the questionnaire survey indicates the need to teach the scientific style of oral speech to technical students.

For the question “How often do students use specialized terms and definitions in their oral communication?” The low numbers of students using terms in oral communication indicates the importance of developing the improvement of professional scientific language.

Figure 10

“How often do students use specialized terms and definitions in their oral communication?”

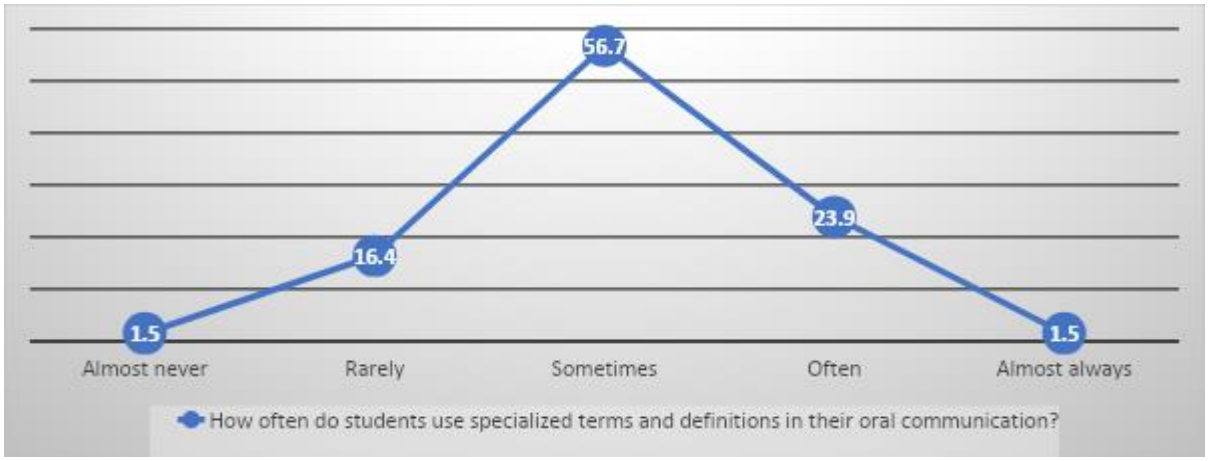
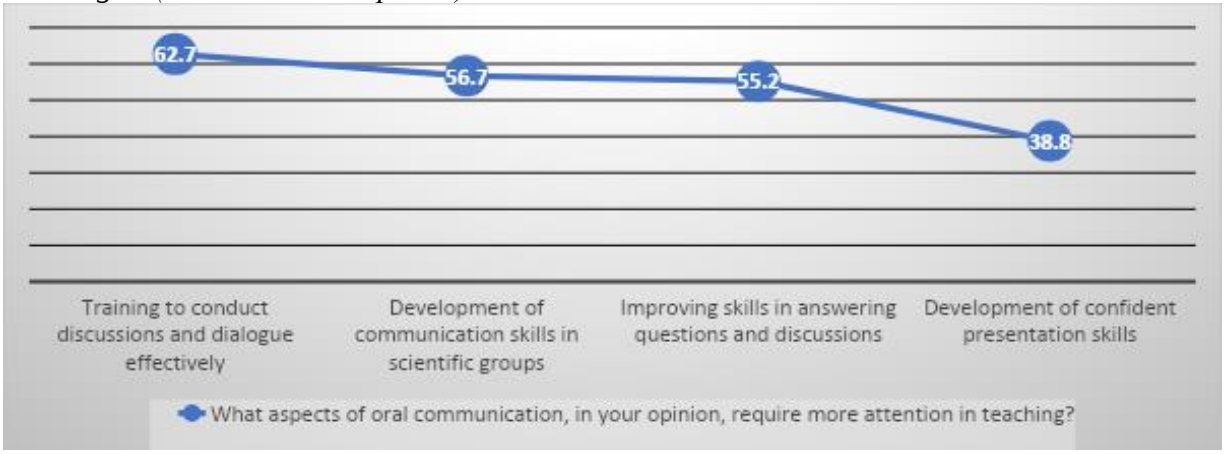


Figure 11

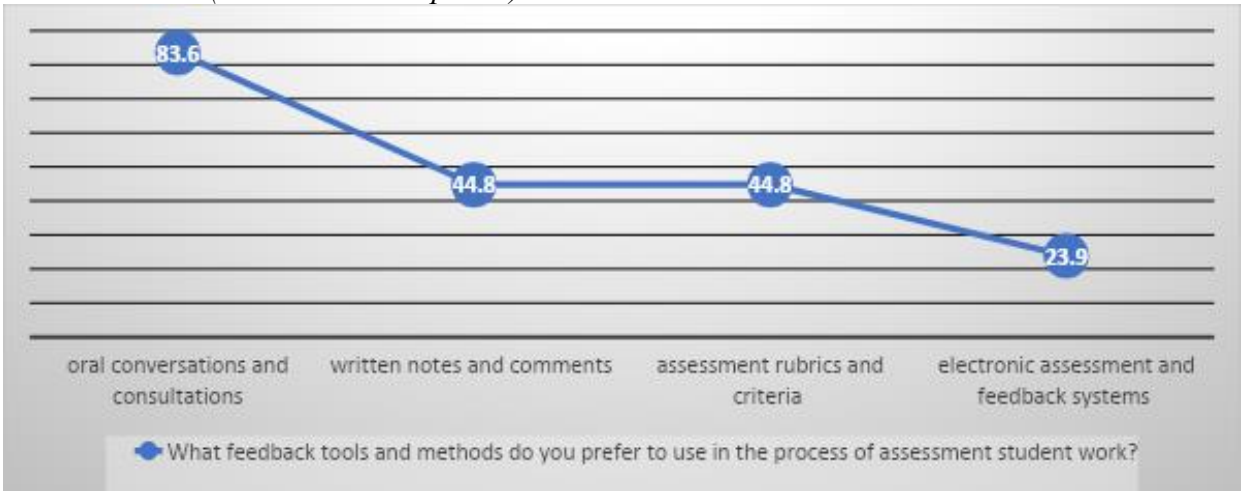
"What aspects of oral communication, in your opinion, require more attention in teaching?" (choose several options)



Part 4 "Feedback and support." For the questions "How often do you provide feedback to students on their written work?" and "How often do you provide feedback to students on their oral communication (for example, after presentations)?" the pattern of answers is almost identical. More than half of respondents (55.2%) responded that they often provide feedback to students on their written work and 52.2% - on oral communication, 37.3% almost always provide feedback to students on their written work and 46.3% - on oral communication, 6% of respondents responded that they sometimes provide feedback to students on their written work and 1.5% responded that they rarely provide feedback to students on their written and oral work.

Figure 12

"What feedback tools and methods do you prefer to use in the process of assessment student work?" (choose several options)



On the question "What changes or improvements in the system of feedback and student support would you suggest to improve the quality of linguistic means teaching in scientific and technical communication?" the majority of respondents agree with the importance and significance of the formation of language skills in scientific and technical discourse and accordingly suggest the development of a special training program on the level system of language teaching with an increase in the amount of hours for written and oral scientific communication.

In response to the final open ended part of the survey, asking for additional comments and suggestions, respondents made proposals to improve the system of teaching scientific communication, namely, to develop a unified electronic assessment and feedback system at the university; to form a group of students where they can discuss and interact within the framework of projects and learning activities; to improve methods of teaching specialized vocabulary and terms; to conduct scientific and technical seminars or webinars with foreign scientists; to introduce a feedback system in accordance with linguistic means of scientific and technical communication, including detailed records of scores and comments on each of the criteria; and to create interactive online resources that will help students practice and develop their language skills in scientific and technical communication.

In the context of the development of written scientific speech, there is an interest in optimizing the learning process through automated worksheets for written work, which will contribute to a deeper understanding of the student The development of skills in working with scientific literature remains open to the introduction of innovative methods in language teaching, and more practice in conducting open discussions and a mentoring system is also needed.

Respondents also noted the problem of teaching pronunciation, which is important in the process of any oral communication, and especially in scientific communication, which requires accuracy and clarity in the presentation of ideas. In this regard, the idea of regular assessment and organization of adequate feedback on work with the pronunciation of scientific and technical terminology and specialized vocabulary with the possibility of recording one's speech has been suggested.

And finally, for the development of oral scientific communication, a proposal was made to create discussion clubs by linguists together with production masters for discussing production situations and solutions to production problems. Such a tandem teaching method or the so-called co-teaching method with close communication with engineering and technical personnel will contribute to the intensification of the scientific language teaching process in technical fields.

Conclusion

The survey on the choice of linguistic means in scientific and technical communication in the training of engineers made it possible to assess what linguistic means of scientific communication are used by teachers and scientists, and to determine the degree of their use in written and oral speech in the training of engineers, as well as to establish preferences and motives of scientists and specialists in choosing linguistic means in the process of writing scientific and technical documentation.

According to the survey results, a generally average or insufficient level of proficiency in scientific communication can be traced, since according to teachers, students have difficulty in understanding specialized terms and definitions and have certain difficulties in expressing their ideas of a scientific and professional character in oral and written speech. The high need of students can be seen in improving scientific writing, namely the development of structuring scientific text and training in data analysis and interpretation.

To develop students' motivation for scientific activity, it is necessary to apply a variety of methods and approaches, including digital technologies with tracking the progress of students' academic performance, wide access to educational, professional and scientific resources, as well as a developed electronic feedback system to provide continuous qualitative assessment of students' knowledge.

These results will be used to develop recommendations for improving scientific and technical communication and providing more effective transfer of scientific information in the

training of engineers through the use of multi-factor SWOT analysis of questionnaire data and a theoretical review on the project research topic.

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The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Damira Jantassova: Data curation, Writing - Original draft preparation, Software, Supervision, Writing - Reviewing and Editing, Investigation, Project administration.

Zhuldyz Tentekbayeva: Conceptualization, Methodology, Resources.

Daniyel Damiyev: Validation, Formal analysis, Visualization.

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